

## CHAPTER 1

### INTRODUCTION

One step in the acquisition of military weapon systems and equipment is the verification that the candidate systems do, in fact, perform in accordance with previously specified operational requirements. The verification process involves the design of test programs which provide an adequate data base to support realistic assessments of hardware characteristics. This text outlines the concepts and techniques to be used in structuring such test programs and analyzing the resulting data.

Since verifying the performance of every hardware item to be procured is neither practical nor possible, we base our projection of the entire population's performance on the assessment of an available sample. This sample may consist of the first 10 **preproduction** aircraft of a projected buy of 725 or 50 percent of a lot of high-reliability pyrotechnic devices. In either case, we are utilizing statistical techniques to project or estimate the true value of some population's characteristic, such as reliability, maintainability, weight, size, etc.

The material contained in the following chapters is designed to familiarize the reader with the various statistical concepts and techniques required to thoroughly understand the relationships among test design, assessment and projection of population characteristics.

The beginning chapters present background material on the three basic quantitative system parameters: reliability, availability and maintainability. The various definitions of these basic terms are discussed, as are the relationships among these parameters. The statistical concepts of confidence and producer's and consumer's risk are next introduced, with **the** majority of the text devoted to the practical application and significance of these concepts. The chapters utilize a combination of narrative and case studies to introduce and illustrate the usefulness of the concepts. It will prove quite useful to refer to the case studies while reading through the chapters. This study technique will prove especially **helpful** in Chapters 7 and 8, which present information on analyzing test data and structuring statistically adequate test programs. Chapter 9 contains an introductory discussion of the reliability growth concept. Chapter 10 presents qualitative aspects **of** test planning along with a description of data collection requirements.

It should be noted that there is no intent here to indicate that all DoD test programs must produce statistically significant test results. Obviously some will, but it is essential to understand the risk associated with a proposed test program and the confidence associated **with** specific results before recommending a course of action.

A first glance at the middle of one of the more "intense" chapters will quickly bring the reader to the conclusion that the real title of the text should have been "Everything You Never Knew about Statistics and Never **Will**"--**SLAM!!** In fact, the text could be entitled "What To Do Until the Statistician Arrives." Anyone able to work through the entire text without

any questions needs no statistician--for most tasks. The text, however, makes no attempt to eliminate the need for expert advice but rather attempts to aid the reader in recognizing the simplicity of some concepts, the complexity of others, the assumptions and limitations associated with all of them, and the importance of the topic to test and evaluation in general.